Posteraustellung

Stiftung zur Förderung der Ernährungsforschung in der Schweiz SFEFS

SFEFS

Stiftung zur Förderung der Ernährungsforschung in der Schweiz
Fondation pour l'encouragement de la recherche sur la nutrition en suisse
Swiss Foundation for Nutrition Research

Zweck dieser Stiftung ist es, die wissenschaftliche Forschung und Bildung von Hochschul-absolventInnen auf dem gesamten Gebiet der Ernährung zu fördern.

Aus- und Weiterbildung

Stipendien werden für die Dauer von 1-2 Jahren zugesprochen. Die Höhe des Stipendiums entspricht in der Regel der Besoldung des Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung. Diese Stipendien sollen ÄrztInnen, Ernährungs- und NaturwissenschafterInnen die Möglichkeit geben, sich an einer anerkannten Forschungsstätte im In- oder Ausland in biochemischer, klinischer oder epidemiologischer Richtung auf dem Gebiet der Ernährungswissenschaft weiter auszubilden. Die StipendiatInnen sind nach Ablauf des Stipendiums frei in der Wahl ihrer beruflichen Betätigung.

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Forschungsbeiträge

zur Unterstützung von wissenschaftlichen Forschungsprojekten auf dem Gebiete der menschlichen Ernährung stehen für die Dauer von 1-2 Jahren ebenfalls zur Verfügung.

Der Bewerbung sind beizulegen: 1) Personalien und Curriculum des Projektverfassers bzw. der Projektverfasserin, Publikationsliste. 2) Forschungsprogramm. 3) Budget und Finanzierung. 4) Angaben über weitere finanzielle Beiträge und ausstehende Gesuche.

Publikationsbeiträge

Der Bewerbung sind beizulegen*:* 1) Druckfertiges Manuskript. 2) Personalien und Curriculum des Autors, der Autorin, resp. Herausgeber. 3) Budget des Verlegers. 4) Angaben über weitere finanzielle Beiträge und ausstehende Gesuche.

Bewerbungen sind jeweils bis spätestens Ende Juli an das Sekretariat der Stiftung zu richten.

Weitere Auskünfte über Förderungsbeiträge erteilt das Sekretariat der Stiftung

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Ziele der Stiftung

Die Stiftung zur Förderung der Ernährungsforschung in der Schweiz hat sich folgende Ziele gesetzt: Weiterbildung junger WissenschafterInnen, Unterstützung von Forschungsprojekten sowie Informationsaustausch mit verwandten Organisationen und WissenschafterInnen, die im Bereich der Ernährungswissenschaft aktiv sind.

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Die Stiftung erteilt Beiträge an Schweizer ForscherInnen oder in der Schweiz tätige WissenschafterInnen. Die AntragstellerInnen sollen innovative Fragestellungen aufgreifen und über die notwendigen theoretischen und methodischen Kenntnisse verfügen. Finanzielle Beiträge werden zur Durchführung experimenteller oder klinischer Untersuchungen sowie für Erhebungen bewilligt (Forschungsbeiträge). Gefördert wird auch die Weiterbildung des wissenschaftlichen Nachwuchses im In- und Ausland, zum Erlernen neuer Methoden oder spezifischer Techniken. Im weiteren vergibt die Stiftung auch Beiträge an Publikationen zwecks Verbreitung wissenschaftlich wertvoller Ergebnisse. Die StipendiatInnen verpflichten sich zur Kooperation mit der Stiftung.

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Schweizer Milchproduzenten SMP, Bern Zweifel Pomy-Chips AG, Spreitenbach

Ancient DNA and Paleoprotein Investigation of Dairying and the Evolution of European Diet

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Abstract

Ruminant milk and dairy products are historically important food resources in many European, African, and Middle Eastern societies. These areas are also known to be associated with derived genetic variants for lactase persistence. Because the only natural source of lactose is milk, it is thought that a culture of dairying must correlate with lactase persistence to some extent. However, the origins of European dairying are poorly understood and leave few traces in the archaeological record. The primary aims of this project were to 1) investigate allele frequencies of the European lactase persistence (LP) allele T-13910 in historic European populations using ancient DNA technologies, and 2) investigate fossilized dental calculus as a reservoir of ancient biomolecules (DNA and proteins) relating to health and diet, including milk consumption. Our research focused on Medieval skeletal collections from Dalheim Germany and Norse Greenland (c. AD 950-1200). For the lactase persistence portion of the project, we investigated 36 human skeletons from the Dalheim collection. For the dental calculus portion of the project, we investigated 10 human skeletons from the Dalheim (n=4) and Norse Greenland (n=6) collections.

Lactase Persistence

Introduction

In mammals, lactase, the enzyme that hydrolyzes the milk sugar lactose, is normally down-regulated after weaning, but in Europe a single nucleotide polymorphism at C/T-13910 causes lactase persistence (LP). When and where this polymorphism evolved and the process by which it rose to high frequency in Europe has been the subject of strong debate. Previous work has reported low, but highly variable frequencies for inferred lactase persistence (C/T and T/T genotypes) phenotype in Neolithic Europe and low frequencies for Medieval Hungary [1-6].

Materials and Methods

DNA was extracted from the dentine of 36 individuals excavated at the Medieval (c. AD 950-1200) cemetery of Dalheim, Germany, in a dedicated clean room with appropriate anti-contamination techniques and amplified using Phusion HotStart II and lac5u primers (F: 5'-GCGCTGGCAATACAGATAAGATA -3' R: 5'- AATGCAGGGCTCAAAGAACAA -3'[Microsynth]) [7]. Extractions and PCRs were repeated and sequences were obtained from multiple reactions by cloning of products.

Results

Amplification of the lactase persistence locus (-13910C/T) was successful for 25 of 36 individuals. For 18 individuals there was consistent amplification across three PCRs from two separate extractions with no contamination. The C/T-13910 alleles are in Hardy-Weinberg equilibrium, and the frequency of the T-13910 allele is 50%. The lactase persistence genotype frequency (C/T and T/T) is 72% (Table 1). No individuals exhibited non-European LP alleles.

Table 1. Results of C/T-13910 genotyping of Medieval Dalheim skeletal assemblage

Sample	Clones analyzed	T-13910 clones	Consensus Genotype	Inferred Phenotype
B7	22	0	C/C	Non-Persistent
B11	21	15	C/T	Persistent
B14	14	9	C/T	Persistent
B15	21	21	T/T	Persistent
B26a	22	0	C/C	Non-Persistent
B27	19	7	C/T	Persistent
B30b2	21	21	T/T	Persistent
B32	21	3	C/T	Persistent
B36	16	5	C/T	Persistent
B39	18	7	C/T	Persistent
B40	20	20	T/T	Persistent
B57	19	0	C/C	Non-Persistent
B59	22	0	C/C	Non-Persistent
B78	24	10	C/T	Persistent
B82	19	19	T/T	Persistent
B85	17	12	C/T	Persistent
B85a1	18	18	T/T	Persistent
G12	20	0	C/C	Non-Persistent

Discussion and Conclusion

The ability to rely on ruminant secondary products, such as milk, likely conveyed selective advantage during times of resource scarcity, and genetic lactase persistence has independently evolved at least five times. Previous ancient DNA studies have established that genetic lactase persistence was low or absent in most European Neolithic populations. In this study, we show that the frequency of lactase persistence in Medieval Germany (72%) is the same as that found today in Germany and Austria (71-80%) [8-11], suggesting that the incomplete selective sweep of the lactase persistence allele may have been complete in western Central Europe by AD 1000. Ancient DNA research has made great strides in narrowing down the period of European LP selection to an approximately 4,000 year window spanning 3000 BC to AD 1000. Future ancient studies on this period are likely to reveal the specific evolutionary forces acting on the T-13910 allele and the relationship between dairying on LP genotypes.

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Ancient Oral Microbiome

Introduction

Dental calculus is a calcified bacterial biofilm that forms on the surfaces of teeth from dental plaque, saliva, and gingival crevicular fluid. It mineralizes during life, entrapping food particles and diverse biomolecules from all domains of life and viruses comprising the oral microbiome. We investigated Medieval skeletal collections to determine if DNA and proteins from dietary sources and the oral microbiome survive in ancient dental calculus.

Results

We find that ancient dental calculus is a robust reservoir of health and dietary information (Figure 1). Unlike most dental tissues, which undergo taphonomy after death as soil bacteria infiltrate dentine and cementum (a), calculus resists soil

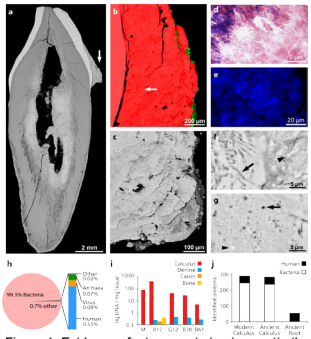


Figure 1. Evidence of microscopic (a-g), genetic (h-i), and proteomic (j) preservation of ancient dental tissues in Dalheim individual B78.

(EDS, green) penetration (b), retains its original laminar structure (c), and preserves bacterial cell walls (d) and DNA (e) *in situ* (f, g). Calculus DNA is >99% bacterial and is dominated by oral taxa (h). DNA concentrations are 10-1000x higher in calculus than in paired dentine (i) or even diseased dentine and bone. By contrast, dentine bacteria resemble those found in soil and other environmental samples. Calculus is also rich in proteins of both bacterial and human origin (j). Taking a closer look at dietary biomolecules (Figure 2), we identified DNA sequences from sheep (a), cruciferous vegetables (b), swine (c), and bread wheat (d) in Dalheim dental calculus. These dietary items are consistent with other dietary evidence at Dalheim, but allow higher taxonomic resolution than conventional methods.

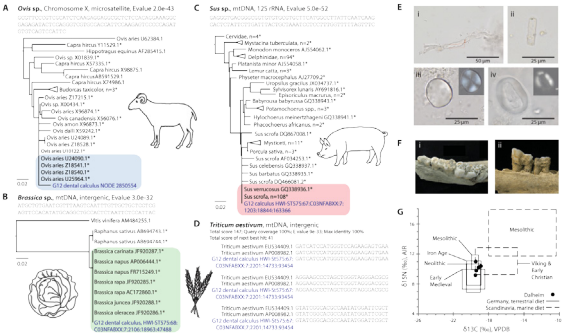
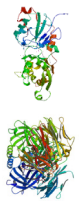


Figure 2. Evidence of Dalheim diet. Dental calculus DNA identifies sheep (a), Brassica sp. (b), swine (c), and bread wheat (d). Microfossils (e) in dental calculus identify animal connective tissue(i), monocot phytoliths (ii), and starch grains of the Triticeae cereal tribe (iii) and Fabaceae bean family (iv). Zooarchaeological analysis (f) of food waste confirms swine (i) and sheep/goat (ii). Stable isotope analysis (g) is consistent with non-marine traditional Central European diets.

In our Norse Greenland samples, we identified three putative dietary proteins (Table 2) originating from ruminant milk (β-lactoglobulin) and skeletal muscle (myosin 2/6/7 and tropomyosin α-1). Although the myosin and tropomyosin peptide sequences are not dietary-specific (they are also found in humans), these proteins are not normally found in dental tissues. Thus, they are of possible dietary origin. Further research will aim to clarify the taxonomic origin of these proteins.

Table 2. Putative dietary proteins identified in Norse Greenland dental calculus

Individual	Protein	Peptides
Z35	Myosin 2/6/7, mammalian Tropomyosin α-1, mammalian	ANLLQAEIEELR QLVEEELDR QLVEEELDRAQER
Z39	β-lactoglobulin, ruminant	TPEVDNEALEK TPEVDNEALEKFDK
Z40	β-lactoglobulin, ruminant	VLVLDTDYK TPEVDNEALEK TPEVDNEALEKFDK (2)



Discussion and Conclusion

Dental calculus shows great potential as a reservoir of dietary and health information. We demonstrate that authentic endogenous DNA and proteins preserve within dental calculus for hundreds, if not thousands, of years. Direct evidence of dairying is difficult to obtain in the archaeological record. The recovery of ruminant milk proteins in Medieval Norse dental calculus suggests that future dental calculus studies of earlier populations may reveal valuable information on the origins of European dairying.

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Urinary lignans and isoflavones and inflammatory markers in the U.S. National Health and Nutrition Examination Survey 1999-2004

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Introduction

Low-grade chronic inflammation has been postulated to play an important role in the development of chronic diseases, e.g. cardiovascular disease, type 2 diabetes mellitus, and various types of cancer (*J Acad Nutr Diet* 2012; **112**(7): 996-1004). An increased risk of chronic diseases has been observed with elevated C-reactive protein levels (CRP) and white blood cell counts (WBC), which are used as biomarkers of inflammation. Phytoestrogens are plant constituents found in many foods. They may act as weak estrogens, but also as antioxidants and anti-inflammatory agents, suggesting a possible role in lowering CRP concentrrations and WBC count (*Nat Toxins* 1998; **6**(2): 51-9; *Front Neuroendocrinol* 2010; **31**(4): 400-19).

Material and Methods

- Included in our analysis were 2628 participants of NHANES 1999-2004 aged 18 years and older
- 1999–2002 urinary phytoestrogens were measured by HPLC-APCI-MS/MS, 2003-2004 by HPLC-EST-MS/MS
- Serum CRP was assessed by latex-based nephelometry, WBC count by Coulter counting
- Log-transformed CRP concentration and WBC count by log-transformed creatinine-standardized concentrations of isoflavones and mammalian lignans were used for linear regression
- Adjustment was made for age, race, smoking, alcohol, poverty income ratio, body mass index, hormone replacement therapy, menopause, cardiovasclular diseases, cancer, hypertension, diabetes, kidney disease

Results

Table 1: Baseline characteristics in CRP level and WBC count in a sample of adults in NHANES 1999-2004[a]

	median	*Q1*	*Q3*
Phytoestrogens (µg/g creatinine)			
Isoflavones[b]	93.58	39.66	277.01
Lignans[c]	436.80	172.86	958.58
Daidzein	47.46	15.53	146.14
Genistein	21.99	8.66	72.56
Equol	6.40	2.92	13.69
O-Desmethylangolesin	2.91	0.56	16.48
Enterodiol	37.02	14.83	84.18
Enterolactone	374.57	122.44	852.12
CRP (mg/L)	1.80	0.70	3.50
WBC (SI)	6.70	5.60	8.00
Age (years)	46	32	65

[a] Values are weightend except medians
[b] Daidzein, equol, genistein, O-desmethylangolensin
[c] Enterodiol, enterolactone
[d] Self-reported

	%
Sex (women)	48.5
Race	
Non-Hispanic white	73.8
Non-Hispanic black	9.4
Mexican-American	7.3
Other	9.5
Poverty income ratio (PIR)	
Below poverty (< 1)	11.4
At or above poverty (≥ 1)	81.7
Missings	6.9
Smoking history	
Current smoker	21.5
Former smoker	24.3
Never	52.3
Missings	1.9
Average number of alcoholic drinks/day - past 12 months	
0	36.1
≤1	29.3
>1	34.7

	%
BMI kg/m²	
<18.5	1.5
≥18.5 - <25.0	33.2
≥25.0- <30.0	34.6
≥30	28.8
Missings	2.0
Hormone replacement therapy in menopausal women	22.4
Postmenopausal status in women	31.0
Chronic diseases[d]	
History of diabetes	6.0
History of hypertension	38.6
History of cancer	6.6
History of CVD	7.0
History of kidney disease	0.6

Results

Table 2: Linear regression: Outcome variable CRP and WBC in the serum, exposure variables phytoestrogen-concentrations in the urine controlled for confounders; NHANES 1999-2004

	unadjusted model					age, sex and race adjusted model					multivariable adjusted model[1]				
	Beta-Coefficient	Standard Error	Change in %[2]	95% CI in %		Beta-Coefficient	Standard Error	Change in %[2]	95% CI in %		Beta-Coefficient	Standard Error	Change in %[2]	95% CI in %	
CRP Concentration															
Isoflavones	-0.007	0.018	-0.7	-4.1	2.9	-0.023	0.019	-2.3	-5.8	1.4	-0.010	0.015	-1.0	-3.9	2.0
Lignans	**-0.050**	**0.015**	**-4.9**	**-7.6**	**-2.1**	**-0.084**	**0.015**	**-8.1**	**-10.7**	**-5.3**	**-0.030**	**0.014**	**-3.0**	**-5.6**	**-0.3**
Daidzein	-0.007	0.015	-0.7	-3.6	2.3	-0.018	0.016	-1.8	-4.8	1.3	-0.012	0.013	-1.2	-3.7	1.4
Genistein	0.002	0.016	0.2	-2.9	3.4	-0.010	0.017	-1.0	-4.2	2.4	-0.002	0.013	-0.2	-2.7	2.4
O-Desmethylangolensin	**-0.015**	**0.010**	**-1.5**	**-3.4**	**0.5**	**-0.024**	**0.011**	**-2.4**	**-4.5**	**-0.2**	-0.016	0.010	-1.6	-3.5	0.4
Enterodiol	**-0.016**	**0.020**	**-1.6**	**-5.4**	**2.3**	**-0.040**	**0.020**	**-3.9**	**-7.6**	**-0.1**	-0.012	0.018	-1.2	-4.6	2.4
Equol	0.000	0.017	0.0	-3.3	3.4	-0.020	0.018	-2.0	-5.4	1.5	0.005	0.018	0.5	-3.0	4.1
Enterolactone	**-0.042**	**0.013**	**-4.1**	**-6.5**	**-1.6**	**-0.065**	**0.013**	**-6.3**	**-8.7**	**-3.9**	-0.022	0.012	-2.2	-4.4	0.2
WBC Count															
Isoflavones	-0.003	0.004	-0.3	-1.1	0.5	-0.005	0.004	-0.5	-1.3	0.3	-0.002	0.004	-0.2	-1.0	0.6
Lignans	**-0.021**	**0.004**	**-2.1**	**-2.8**	**-1.3**	**-0.022**	**0.004**	**-2.2**	**-2.9**	**-1.4**	**-0.012**	**0.004**	**-1.2**	**-2.0**	**-0.4**
Daidzein	-0.002	0.004	-0.2	-1.0	0.6	-0.003	0.003	-0.3	-0.9	0.3	-0.001	0.003	-0.1	-0.7	0.5
Genistein	0.000	0.004	0.0	-0.8	0.8	-0.002	0.004	-0.2	-1.0	0.6	-0.001	0.003	-0.1	-0.7	0.5
O-Desmethylangolensin	-0.005	0.003	-0.5	-1.1	0.1	-0.006	0.003	-0.6	-1.2	0.0	-0.002	0.002	-0.2	-0.6	0.2
Enterodiol	**-0.015**	**0.004**	**-1.5**	**-2.3**	**-0.7**	**-0.017**	**0.004**	**-1.7**	**-2.5**	**-0.9**	**-0.010**	**0.004**	**-1.0**	**-1.8**	**-0.2**
Equol	0.000	0.005	0.0	-1.0	1.0	-0.004	0.005	-0.4	-1.4	0.6	0.000	0.005	0.0	-1.0	1.0
Enterolactone	**-0.016**	**0.003**	**-1.6**	**-2.2**	**-1.0**	**-0.016**	**0.003**	**-1.6**	**-2.2**	**-1.0**	**-0.008**	**0.003**	**-0.8**	**-1.4**	**-0.2**

[1]adjusted for age, race, sex, smoking status, alcohol consumption, poverty income ratio, bmi, hrt-users, menopause, cvd, cancer, hypertension, diabetes, kidney disease
[2] % change in CRP per 1% change in phytoestrogens

Summary

- Statistically significant inverse associations of urinary lignan, enterodiol and enterolactone concentrations with circulating CRP and WBC count were found.
- No significant associations of isoflavones with CRP concentrations and WBC counts with the exception of O-desmethylangolensin (O-DMA) with CRP adjusted for race, sex and age were observed (too low concentrations?).
- Our findings might be of importance for the prevention of chronic diseases such as CVD.

Conclusions

Urinary concentrations of mammalian lignans were inversely associated with markers of chronic inflammation. Mechanisms of action are widely unknown, but lignans may act as antioxidants. These cross-sectional data do not allow causal inferences. Our findings require confirmation in prospective studies.

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Vegetable variety: An effective strategy to increase vegetable choice in children

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Most children do not meet the recommended intake of vegetables. Variety was identified as a potential factor to increase children's intake of these foods, as it was shown that variety was effective in improving meal composition in adults. Because younger children are suggested to be more responsive to internal satiation signals than to external food-related cues compared to adults, it is not clear whether variety is effective to improve meal composition in 7 to 10 year-old children. In the present study, we used a fake food buffet to assess whether vegetable variety improves 7-to-10-year- old children's meal composition.

Background

Even though vegetable variety was shown to be effective in improving the composition of adults' meals (Bucher 2011), it is not clear, whether vegetable variety also nudges children to choose a healthier meal. When younger children select a meal, food-related cues such as variety might be of minor importance, while the responsiveness to liking or signals such as hunger and satiety might be more important (Ashcroft 2008).

In the present study, we used a fake food buffet with four replicas of foods commonly eaten for a hot meal in Switzerland, to assess whether vegetable variety improves 7-to-10-year- old children's meal composition.

Experiment

100 children (*n* = 52 boys) were randomly assigned to one of three different replica food selections. The buffet under condition 'carrots' (*n* = 32) consisted of cooked carrots, pasta and chicken. Under condition 'beans', (*n* = 34) children could serve themselves green beans, pasta, and chicken, and under condition 'carrots & beans' (*n* = 34), children were offered both vegetables in addition to pasta and chicken (Fig.1 left panel). In the experiment each child was asked to serve him- or herself a meal, from the presented selection, such as he or she would like to eat for lunch from on a normal school day. The experiment took place in the absence of the parent.

Figure 1. Experimental conditions. Left: Four Fake Foods were presented in metal serving dishes. Right: Child serving from the Fake Food Buffet.

Results

Children given the two-vegetable choice served themselves significantly more energy from vegetables (*M* 64 (SD 51) kJ, 10.9 (*SD* 9.4)%) compared to children who were only offered either carrots (*M* 37 (SD 25) kJ, *M* 5.9 % (*SD* 6.5)) or beans (*M* 38 (SD 34) kJ, *M* 5.6 (*SD* 6.3)%).

The total energy of the meal was not increased, indicating that children chose a more balanced lunch when offered more vegetables.

	Total (n 100)		Carrots (n 32)		Beans (n 34)		Carrost & Beans (n 34)				
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	$F_{(2,97)}$	*P*	η_2
Total energy from vegetables (kJ)	46	40	37^{b}	25	38^{b}	34	64^{a}	51	5.10	.008	.095
Total energy from meal (kJ)	759	297	725	282	811	256	739	297	0.81	.448	.016
Percentage energy from vegetables (kJ)	7.5	7.9	5.9^{b}	6.5	5.6^{b}	6.3	10.9^{a}	9.5	5.14	.008	.096

^{a,b}: Means with different superscripts in each row are significantly different ($P < .05$). Bonferroni post hoc tests were reported ($\alpha = .05$).

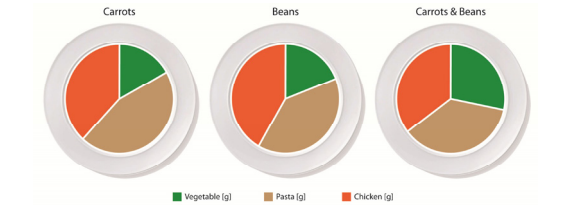

Figure 2. Visualization of the food proportions of the plate. Increasing the choice of vegetables results in a more balanced choice with a higher amount of calories from vegetables.

Discussion

Serving a bigger variety of vegetables at lunch in school cafeterias or after-school nurseries seems to be a simple and effective public health intervention.